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ESTIMATES OF WILDERNESS CONSUMPTION

for the year 2020

by

Frank A. Ward

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STATE and PRIVATE FORESTRY

Area Planning and Development

USDA
Forest Service
P.O. Box 25127
Denver, CO 80225

April 1976

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ESTIMATES OF WILDERNESS CONSUMPTION FOR THE YEAR 2020

by

Frank A. Ward

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submitted to

Bruce Benninghoff
River Basin Programs
Area Planning and Development
State and Private Forestry

U.S.D.A.

Forest Service
P.O. Box 25127
Denver CO. 80225
March 1976

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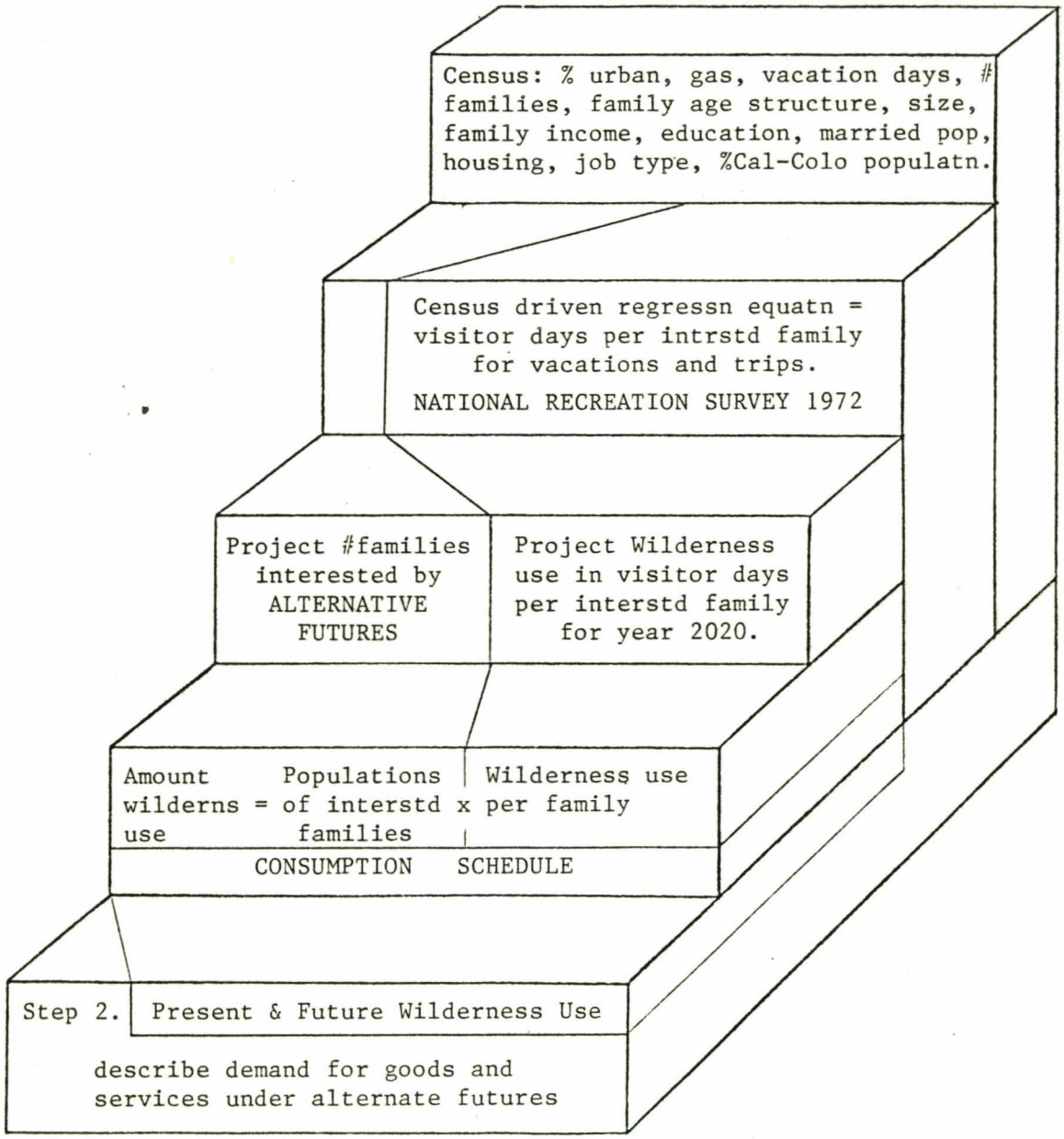
Figure ii Relationship of this Paper to

M U L T I - O B J E C T I V E P L A N N I N G

Step 2. Describe Demand for Goods and Services Under Alternate Futures

This paper treats the *wilderness* demand relationship.


Census: % urban, gas, vacation days, # families, family age structure, size, family income, education, married pop, housing, job type, %Cal-Colo populatn.
Census driven regressn equatn = visitor days per intrstd family for vacations and trips.
NATIONAL RECREATION SURVEY 1972
Project #families interested by ALTERNATIVE FUTURES
Project Wilderness use in visitor days per interstd family for year 2020.
Amount wilderns use = Populations of interstd families x Wilderness use per family
CONSUMPTION SCHEDULE
Step 2. Present & Future Wilderness Use
describe demand for goods and services under alternate futures

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Introduction

Since 1946 the use of wilderness for recreational purposes has increased five times as fast as population growth over the same period. In fact:

> ". . . recreational use of wilderness has increased about 10 per cent a year, a faster rate than most other forms of forest recreation and considerably beyond our population growth rate (about 2 per cent per year.) Projections of future wilderness use indicate the rapid growth experienced in the past will continue, at least for some time"[1]

In order to help meet the Water Resource Council "Principles and Standards" criteria for river basin planning, the U.S. Forest Service, State and Private Forestry would like to determine the underlying causes of this rapid and continued increase in wilderness use. It is the purpose of this study to project recreational use of wilderness to the year 2020 through the use of multiple linear regression using the 1972 National Recreation Survey (NRS) data. This National Recreation Survey was conducted by the Bureau of the Census for the Outdoor Recreation Resource Review Commission (ORRRC) in 1972. Using the prediction regression equation, the key variables will be projected to the year 2020 to obtain an estimate of recreational wilderness use for that point in time.[2] The projections will be done on a national basis with the intent that this method will be suitable for prorating to the regional level.

Economic Concepts

At the outset it is necessary to distinguish wilderness demand from wilderness consumption. A market demand schedule reflects how the flow of a commodity purchased varies with its market price. Consumption, on the other hand refers to total quantities bought at given market prices. Clearly a consumption schedule reflects the interaction between supply and demand. Clawson says:

> "Two ambiguities, in particular, have detracted from its (demand's) usefulness as a guide to planning. . . Although the whole recreation experience entails costs, which influence the numbers of visits to recreation areas, the outdoor recreation resources or facilities themselves are customarily available at zero or nominal prices or charges. The "demand" that is often cited for outdoor recreation refers, then, to the demand at such prices. The millions of days of outdoor recreation currently being consumed are those demanded at the prevailing zero or near zero prices for these resources. If prices were raised substantially by the imposition of entrance fees or by some other means, a very different quantity would be demanded, or consumed.
>
> A second difficulty involving the use of the word "demand" as commonly applied to outdoor recreation, stems from its incorrect application as a description of use or consumption. Usually what is called "demand" is gross attendance or use made of the facilities. It refers to the quantities taken at the prevailing recreation opportunity condidions, for consumption depends both on demand and the availability of supply. That is, the data are use or attendance figures for existing facilities. Such statements do not separate demand and supply conceptually or statistically."3

At a later point Clawson says:

> "Projection of consumption figures are really then projections of demand with some implied relations of demand to supply. What is implied is that recreation consumption

> will increase, and that this increase is based on a shift or increase in demand and expanding levels of supply. As long as these relationships are understood, there is considerable merit, for planning and policy guidance, in examining the likely trends of future recreation participation."[4]

In this study it is a consumption schedule which will by estimated by relating wilderness use to other causal variables.

There were two functional forms of the consumption schedule that were considered for this study. The first form, used by Kalter and Gosse in their recreational demand study of the State of New York, is the double logarithimic modification of the simple linear regression equation.[5] Given the general consumption equation:

1. $Q = f(x_1, \ldots x_n)$

   Q = quantity consumed

   $x_1, \ldots x_n$ = factors affecting Q

the double log form of this equation looks like the following:

2. $\log Q = B_o + B_1 \log(x_1) + \ldots + B_n \log(x_n)$

Putting both sides of equation 2 into the exponent we have the same equation expressed slightly differently:

3. $Q = B_o x_1^{B_1} x_2^{B_2} \ldots x_n^{B_n}$

Because equation 3 displays constant elasticities[6] throughout its range equal to the B_i exponents, it is used often by economists in empirical research. It is also a desirable functional

form because the nonlinearity in the variables can yield higher R^2 values than the simple linear counterpart. However two major drawbacks to this double log functional form warranted the choice against its use for this study. The first problem, a minor one, lies in applying constant elasticity formulas to the equation. Although this function does display constant elasticities for infinitesimally small percentage changes in the variables, this desirable attribute does not hold for larger changes. That is, for very small changes, $(\frac{dx_i}{dQ})(\frac{Q}{x_i})$, the relative percentage change of quantity to a percentage change in x_i, is equal to the exponent B_i. However for any change other than very small ones (for example 10%), the percentage change in Q relative to the percentage change in x_i is not equal to the exponent B_i. But this is only a minor problem, for it merely makes calculations of percentage changes (when projecting new values for the independent variables) somewhat cumbersome.

The major problem with the double log functional form is associated with projecting median or mean values of the independent variables. More explicitly, if any functional form other than the linear one is chosen as the model, projecting mean or median values for the independent variables will not yield the true median or mean of the dependent

variable. Consider the following relationship:

$$4. \qquad Q = B_1 x_1^2$$

The mean value of Q does not equal B_1 times the mean value of x_1 squared. In fact the linear model is the only form where a function of the mean values of the independent variables yields mean values of the dependent variable. The same result holds for median values.

For the reasons listed above, the linear functional form was chosen for this study. The following equation is an example of the linear functional form (in both the variables and the parameters):

$$5. \qquad Q = B_o + B_1 x_1 + \ldots + B_n x_n$$

Use and Retrieval of Data

The data used for this study consisted of the output of the 1972 National Recreation Survey (NRS) performed by Audits and Surveys Incorporated under contract with the U.S. Department of Interior. There were 4029 randomly selected households (sample points) which were interviewed in the study. Three types of information were obtained in the survey making up a total of 717 variables,

". . . including the number of days of participation

> in various activities on outdoor recreation occasions during summer, travel information about those occasions, and socio-economic data concerning the person who reported participating in the activities."[7]

A computer printout of the 717 variables for all 4029 interviews was obtained from the Bureau of Outdoor Recreation. A list of the variables chosen for the present study along with cross references to National Recreation Survey variables can be found in Appendix "A."

Since the goal of the present study was to project the consumption schedule of wilderness to the year 2020, it was necessary to determine a suitable proxy for wilderness consumption from the available list of National Recreation Survey activities. That which corresponded most nearly with wilderness use was the variable "camping in remote or wilderness areas." It was also considered that the variable "hiking with a pack/mountain/rock climbing" might be related to wilderness use, but because such hiking could take place elsewhere it was dropped from further considereation. Clearly by limiting wilderness use to camping, wilderness day use is not being considered, so this shortcoming must be kept in mind.

Of the sample of 4029 households, 140 were found to have reported camping for at least one day in remote or wilderness areas on either a vacation or a primary trip (trip # 1).

However of these 140 cases there were many people who informed the interviewer that the age and education of the household head was zero. This "zero-age-and-education" phenomonon appeared in 50 of the 140 cases. In this study there was a very high percentage (36%) of bad or missing data on age-education. The bad data was dropped because to assign average values to the data might have biased the regressions and given scrambled results. Whether there were sufficient data remaining is debatable.

It was also found that in approximately 75% of the 140 cases the interviewer recorded a zero (not answered) figure for the number of days worked per week. For that reason, this variable was also dropped from the analysis.

In the National Recreation Survey study, participation in all activities were classified as to whether this occurred on a vacation, a trip, or an outing. Because outings were defined to have not been an overnight excursion, the variable "camping in remote or wilderness areas," was defined only as applying to vacations or trips, and did not include outings. Furthermore one activity day was defined to be a 24-hour day.[10] Here it should be noted that although the National Recreation Survey defined an activity day to consist of 24 hours, the U.S. Forest Service defines a visitor day to be 12 hours.

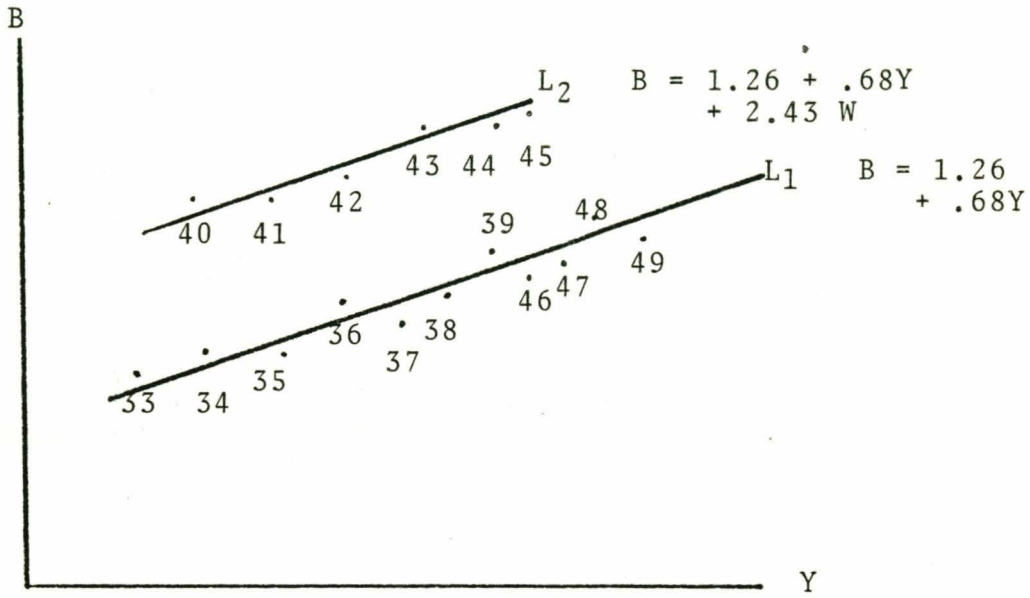
Hence in the present study one activity was calculated as two visitor days.

Choosing the Variables

In this regression model, visitor days per family was chosen as the dependent variable. This dependent variable was regressed on the independent variables for both vacations and trips. In order that this study have continued flexibility for future use, it was recognized that in many cases, there might be otherwise accurate data that failed to separate wilderness use into trips versus vacations. Thus, to allow this study to be applicable to as wide a range of available data as possible an aggregation of trip and vacation days was also regressed on the dependent variables. Hence, there were three equations constructed; one using vacations as the dependent variable, one using trips, and one using both.

In choosing the independent variables, primary consideration was given to ease of obtaining projected values rather than obtaining the smallest possible confidence intervals or the highest R^2 values. All variables were considered on a per family basis, rather than on a per capita or a per adult basis. The variables chosen were of both the normal and the "dummy" or dichotomous" type. Following is a brief description and an example of the dummy variable concept:

Suppose we wish to investigate how the public purchase of government bonds (B) is related to national income (Y). A hypothetical scatter of annual observations of these two variables is shown for Canada in Figure 1 . . . It is immediately evident that the relationship of bonds to income follows two distinct patterns--one applying in wartime (1940-1945), the other in peacetime.



The normal relation of B to Y (say L_1) is subject to an upward shift (to L_2) during wartime; heavy bond purchases in those years is explained not by Y alone, but also by the patriotic wartime campaign to induce public bond purchases. B, therefore, should be related to Y and another variable--war, W. But this is only a categorical, or indicator variable. It does not have a whole range of values, but only two: we arbitrarily set its value at 1 for all wartime years and at 0 for all peacetime years."[11]

For human behavioral studies dummy variables can prove to be very useful in accounting for the effect of otherwise

non-quantifiable influences. For example we might expect marital status of the household head to be an important factor in influencing the number of visitor days spent in the wilderness. In the present study the following socioeconomic dummy variables were considered:

1. If household head lived in an urban area
   (1 if urban, 0 otherwise)
2. If household head lived in suburban area
   (1 if suburban, 0 otherwise)
3. If household head was married
   (1 if unmarried, 0 if married)
4-14. If household head had one of 12 occupations listed under NRS variable #712
   (1 if employed in given occupation, 0 if not
15. If household head lived in single-dwelling home unit
   (1 if single dwelling residence, 0 if not
16. If household head lived in California or Colorado
   (1 if lived in Calif. or Colo., 0 if not)

The normal continuous variables that were included were as follows:

1. A proxy for gasoline expenditures equal to $.024 per mile ($.036 per mile if a camper or motor home was used on the activity) times the number of miles traveled, where it was assumed that driving was the primary mode of transportation.
2. Size of family
3. Total visitor days of wilderness consumed, equal to total days consumed times number of family on trip times two (visitor days per activity day)
4-7. Number of family members in four age groups:
   a. Under 6
   b. 6-11
   c. 12-18
   d. 18 and over

8. Number of vacation days per year received by head of household
9. Family yearly income in thousands of dollars before taxes. This variable was recorded in the NRS study as falling in one of eight classes. For the present study the variable was transformed from NRS variable #704 to the midpoint of each class. For incomes in the class of $35,000 and up, the class average was assumed to be $40,000. NRS variable #704 was the income of the head of the household. This figure was inflated if the household head was married. The inflation factor was 1.27 where the .27 was taken to be the probability of having a working wife (.37)[12] times the percentage of his income that the working wife would be expected to earn. (.75)[13]
10. Years of education, head of household

A complete list of the variables, variable numbers, and NRS cross reference codes can be found in Appendix "A."

Due to the nature of the available stepwise regression computer program (from the 1970 UCLA BioMedical series entitled BMD02R) certain variables had to remain in the program even though they would be considered useless. For example the dependent variable, visitor days of wilderness, was obtained by multiplying visitor days per family times "number of family on trip or vacation." Hence, although "number of family on trip or vacation" retained its identity as a variable, the computer was instructed to delete it from the final regression equation. A list of such deleted variables can be found in Appendix "A."

One final note is worth mentioning in this section. It might appear contradictory that family size was included as an

independent variable while number of family on the trip was deleted. There are two reasons for this. First, visitor days per family, the dependent variable, was obtained by multiplying visitor days per family times number of family on trip. Because "number of family on trip" is part of the dependent variable, including it as an independent variable would overstate the predictive value of the equation. Second, family sizes are much less difficult to project than number of family on a given type of trip or vacation.

Final Regression Equations

In the final model there were three regression equations. The equations are displayed in Appendix "B." In all cases, variables were allowed to enter the prediction equation when the "F" rations associated with their estimated coefficients exceeded unity. An F ratio of unity corresponds to an approximate 70% level of significance. This means that when the F value is larger than one there is a 70% probability that there is more than just a random relationship between the dependent and independent variables. Confidence limite are given in Appendix "D" for all projected values of the dependent variables. We now turn to the three regression equations themselves.

The first equation relates the quantity of visitor days

of remote wilderness camping on vacations to the 26 independent variables indicated in Appendix A, part I. In equation I there were 66 observation points.

Equation II relates the quantity of visitor days of wilderness camping on trips to the 26 independent variables listed in Appendix "A" part II. There were 40 observation points from which equation II was constructed.

The dependent variable in equation III is total visitor days of wilderness camping per family, whether they occurred on a trip or on a vacation. There were 96 observations points making up equation III.

The computed regression equations appear below. The equations are taken directly from Appendix "B." The difference between these equations and those appearing in Appendix "B" is that these equations give actual projected numbers. In particular the resulting values are estimated number of activity days per interested family in the year 2020. An "interested family is one which would consume at least one day of wilderness camping. The number below to the left of the independent variable is its 1972 value; below and to the right is its projected 2020 value.

Equation I. (Visitor days of vacation per interested family)

$$X_6 = 6.25433 + \underset{(.399)}{17.45}\ X_2 + \underset{(40.23)}{.19453}\ X_3 + \underset{(3.90)}{18.50}\ X_4 - \underset{(.4)}{19.12}\ X_7 - \underset{(.437)}{9.55}\ X_8 - \underset{(2.6)}{18.47}\ X_{11} - \underset{(2.7)}{1.24}\ X_{11} + \underset{(.162)}{29.35}\ X_{21}$$

EQUALS 1972---------34.76 (visitor days per interested family)

2020---------48.16 (visitor days per interested family)

Equation II. (Visitor days of trips per interested family)

$$X_6 = -23.26 - \underset{(.399)}{12.55}\ X_2 + \underset{(13.14)}{.182}\ X_3 + \underset{(3.90)}{8.41}\ X_4 + \underset{(2.6)}{6.58}\ X_{10} - \underset{(.064)}{20.28}\ X_{19} - \underset{(.129)}{16.33}\ X_{20}$$

EQUALS 1972---------25.56 (visitor days per interested family)

2020---------29.59 (visitor days per interested family)

Equation III (Visitor days of remote camping whether it occurred on a vacation or on a trip)

$$X_{10} = .832 + \underset{(26.69)(38.96)}{.110\ X_3} + \underset{(.437)(.488)}{7.93\ X_{12}} + \underset{(.463)(.455)}{12.76\ X_{13}} + \underset{(2.600)(2.580)}{6.20\ X_{14}} - \underset{(2.705)(3.291)}{.5628\ X_{15}}$$

EQUALS 1972--------27.74 (visitor days per interested family)

2020--------28.94 (visitor days per interested family)

When a regression equation is to be used as a predictor, it is necessary to apply projected values of the independent variables to the equation. The approach taken to arrive at actual values of total visitor days consumed in 2020 is outlined below:

First the median of each continuous variable[15] was projected to the year 2020. The percentage of the population possessing the attribute of each dummy variable was also projected to the year 2020. This process was used to obtain projections of the dependent variable "visitor days per interested family." It is the results of these computations that are given in the

above three equations. The next step was to determine the percentage or proportion of all families which were wilderness campers. This percentage was obtained in two steps. Step one estimated the number of families that engaged in wilderness camping in 1972. This was achieved by dividing total visitor days of wilderness camping[16] in 1972 by the estimated number of visitor days per participating family, where the denominator was obtained by applying national medians to the regression equation. Step two divides the estimated number of participating families by the total number of families in the country as of 1972.[17] It is this figure which gives the percentage of families which spent some time in the wilderness. This percentage was calculated for vacations, trips, and the combination "vacations-trips."

To obtain projections of total wilderness days consumed, the above percentage figure of interested families was multiplied by the estimated population of 2020, and the resultant was divided by the estimated median family size for the year 2020. Next the (tenuous) assumption was made that the percentage of interested families will not change over time. This gave us the estimated number of families participating in wilderness camping in 2020. This figure was then multiplied by

$$\frac{\text{2020 population}}{\text{2020 family size}} = \text{2020 no. of families x \% interested} = \text{no. of interested families}$$

the projected per family national medians of the independent variables to yield the final estimates for total wilderness visitor days per year as of the year 2020. Here again, the projections were made for vacations, trips, and both. The results are summarized in Appendix "D" and are discussed below.

Summarizing Remarks

The desired end of this study was to obtain projected values for total consumption of wilderness. Following the above discussion, Appendix "D" was constructed. It is Appendix "D" that gives us our final desired figures, and to which we now turn our attention.

The bottom figure of Column III says that there will be a consumption of 221,230,036 visitor days in the year 2020. This figure was obtained by assuming that the same percentage (approximately 7%) of a larger population with slightly different characteristics (the projected values of the independent variables) will be using the wilderness as is currently using it. If this figure were used for policy purposes it would be assumed that we do know the current total value of wilderness camping consumed, but that we do not know the relative percentages used on trips and on vacations.

However, if the figures from columns I and II were summed to obtain an estimate for 2020, it would be assumed that not

only do we know 1972 aggregate consumption levels, but that we know the relative proportions used for trips and vacations. (An explanation is given in Appendix "D" why columns I and II do not sum to column III)

If there is a high degree of confidence in the relative percentages consumed on trips and vacations (see endnote 16) we should project total visitor days of remote and wilderness camping for 2020 to be the sum of columns I and II in Appendix "D." This equals 176,467,583 + 97,610,397 = 274,077,980 visitor days. If there is little or no confidence in the relative percentages we should use the total in column III, Appendix "E." This equals 221,230,036 visitor days.

TABLE OF APPENDIXES

APPENDIX A . . . . . Cross References between variable numbers, NRS variable numbers, and variable names

APPENDIX B . . . . . Contains final regression equations

APPENDIX C . . . . . A list and a list of sources for projections of the independent variables

APPENDIX D . . . . . Projected values of total visitor day consumption of wilderness, 2020

APPENDIX A

Appendix A is divided into three parts. It contains a listing of all variables considered for the final regression equations. (Of course only those variables with F-values in excess of 1.0 actually entered the equations.) It all three parts, these variables are defined and are given an NRS (National Recreation Survey) cross-reference number.

Part I contains the variables used in the Vacation equation. Part II contains the variables used in the equation predicting wilderness Trips. Part III contains the list for the equation relating wilderness camping to the independent variables, whether the camping occurred on a vacation or a trip. Some of the variables were required to retain their identity due to the nature of the regression program, even though they were not used. The computer was instructed to delete these variables from the final regression equation. The delete (DEL) notation is indicated in all relevant cases.

PART I -- VACATIONS

Variable	NRS Variable Number(s)	Description
1.	2 ---------- (dummy)	0 if not urban residence, 1 if urban
2.	2 ---------- (dummy)	0 if not suburban residence, 1 if suburban
3.	36,38----------	A proxy for gasoline expenditures--equal to the miles traveled on vacation times 2.4 ¢ per mile (3.6 ¢ if a camper or motor home was used)
4.	674,675,676,677---------	Family size--equal to the sum of members in all age groups
5. (DEL)	39 ----------	Number of family participating in vac.
6.	131,39----------	Total visitor days of remote camping consumed on vacation--equal to NRS #39 times two visitor days per activity day
7.	674----------	Number of children under six in family
8.	675----------	Number of children six to eleven
9.	676----------	Number of children twelve to eighteen
10.	677----------	Number of adults over eighteen
11.	703----------	Number of vacation days per year other than holidays (received by household head)
12.	704,708----------	Yearly family income--equals household head's income plus .277 times head's income, if head is married male.
13.	708---------- (dummy)	0 if household head is married, 1 if not
14.	709----------	Age, head of household
15.	710----------	Education, head of household
16.	712---------- (dummy)	1 if farmer or farm worker, 0 if not
17.	712---------- (dummy)	1 if manager, official or proprietor, 0 if not

Variable	NRS Variable Number(s)		Description
18.	712----------	(dummy)	1 if clerical or kindred, 0 if not
19.	712----------	(dummy)	1 if sales worker, 0 if not
20.	712----------	(dummy)	1 if craftsman, foreman,0 if not
21.	712----------	(dummy)	1 if operative or kindred, 0 if not
22.	712----------	(dummy)	1 if private household worker, 0 if not
23.	712----------	(dummy)	1 if service worker (except private household), 0 if not
24.	712----------	(dummy)	1 if farm laborer or foreman, 0 if not
25.	712----------	(dummy)	1 if laborer (excluding farm and mine) 0 if not
26.	712----------	(dummy)	1 if in armed forces, 0 if not
27.	716----------	(dummy)	1 if family lives in single dwelling unit, 0 if not
28.	717----------	(dummy)	1 if family from California or Colorado, 0 if not

PART II -- TRIPS

Variable	NRS Variable Number(s)	Description
1.	2---------- (dummy)	1 if urban residence, 0 if not
2.	2---------- (dummy)	1 if suburban residence, 0 if not
3.	44,46----------	Proxy for gasoline expenditures--equal to the miles traveled on trip times 2.4¢ per mile (3.6¢ per mile if camper or motor home was used)
4.	674,675,676,677---------	Family size--equal to the sum of members in all age groups
5. (DEL)	47----------	Number of family members participating on trip
6.	189,47----------	Total visitor days of remote camping consumed on trip--equal to NRS # 189 times NRS # 47
7.	674----------	Number of children under six in family
8.	675----------	Number of children six to eleven
9.	676----------	Number of children twelve to seventeen
10.	677----------	Number of adults over eighteen
11.	703----------	Number of vacation days per year other than holidays received by household head
12.	704,708----------	Yearly family income--equals household head's income plus .277 times head's income if head is married male.
13.	708---------- (dummy)	0 if household head is married, 1 if not
14.	709----------	Age, head of household
15.	710----------	Education, head of household
16.	712---------- (dummy)	1 if farmer or farm worker, 0 if not
17.	712---------- (dummy)	1 if manager, official or proprietor, 0 if not
18.	712---------- (dummy)	1 if clerical or kindred, 0 if not
19.	712---------- (dummy)	1 if sales worker, 0 if not

Variable	NRS Variable Number(s)		Description
20.	712----------	(dummy)	1 if craftsman, foreman, 0 if not
21.	712----------	(dummy)	1 if operative or kindred, 0 if not
22.	712----------	(dummy)	1 if private household worker, 0 if not
23.	712----------	(dummy)	1 if service worker (except private household), 0 if not
24.	712----------	(dummy)	1 if farm laborer or foreman, 0 if not
25.	712----------	(dummy)	1 if laborer (excluding farm and mine), 0 if not
26.	712----------	(dummy)	1 if in armed forces, 0 if not
27.	716----------	(dummy)	1 if family lives in single dwelling home unit, 0 if not
28.	717----------	(dummy)	1 if family from California or Colorado, 0 if not

PART III -- VACATIONS-TRIPS (unspecified)

Variable	NRS Variable Number(s)	Description
1.	2---------- (dummy)	1 if urban residence, 0 otherwise
2.	2---------- (dummy)	1 if suburban residence, 0 otherwise
3.	36,38,44,46----------	Proxy for gasoline expenditures, equal to miles on wilderness vacation times 2.4¢ per mile (3.6¢ if camper or motor home) plus miles on wilderness trip times 2.4¢ per gallon
4.	674,675,676,677----------	Family size--equal to the sum of members in all age groups
5. (DEL)	39----------	Number of family participating on wilderness vacation
6. (DEL)	44,46----------	Gasoline cost on wilderness trip
7. (DEL)	46---------- (dummy)	1 if camper or motor home used on trip, 0 otherwise
8. (DEL)	47----------	Number of family on trip
9. (DEL)	131,39----------	Total visitor days of remote camping consumed, same as variable 6 under vacations
10.	39,47,131,189----------	Total visitor days consumed on trip and vacation--equal to the sum of variable 6 under vacations plus 6 under trips
11.	674----------	Number of children under six in family
12.	675----------	Number of children six to eleven in family
13.	676----------	Number of children twelve to eighteen in family
14.	677----------	Number of adults over eighteen in family
15.	703----------	Number of vacation days per year not including holidays received by household head
16.	704,708----------	Yearly family income--equals household head income plus 27.7 percent if household head is married male.

Variable	NRS Variable Number(s)	Description
17.	708---------- (dummy)	1 if household head is unmarried, 0 otherwise
18.	709----------	Age in years, head of household
19.	710----------	Education in years, head of household
20.	712---------- (dummy)	1 if farmer or farm worker, 0 otherwise
21.	712---------- (dummy)	1 if manager, official or proprietor, 0 otherwise
22.	712---------- (dummy)	1 if clerical or kindred, 0 otherwise
23.	712---------- (dummy)	1 if sales worker, 0 otherwise
24.	712---------- (dummy)	1 if craftsman, foreman, or kindred, 0 otherwise
25.	712---------- (dummy)	1 if operative or kindred, 0 otherwise
26.	712---------- (dummy)	1 if private household worker, 0 otherwise
27.	712---------- (dummy)	1 if service (not household), 0 otherwise
28.	712---------- (dummy)	1 if farm laborer or foreman, 0 of not
29.	712---------- (dummy)	1 if laborer (excluding farm and mine), 0 if not
30.	712---------- (dummy)	1 if in armed forces, 0 if not
31.	716---------- (dummy)	1 if family lives in single dwelling home unit, 0 if not
32.	717---------- (dummy)	1 if family was from California or Colorado, 0 if not

APPENDIX B

Appendix B contains the three final regression equations. In addition to identifying the variables by numbers, an abbreviated name appears below each number. Numbers in parentheses beneath the estimated coefficients indicate their standard errors.

EQUATION I: (Vacations)

$$X_6 = 6.25 + \underset{\substack{\text{SUBURBAN}}}{\underset{(12.26)}{17.45\ X_2}} + \underset{\substack{\text{GASCOSTS}}}{\underset{(.09)}{.19\ X_3}} + \underset{\substack{\text{FAMILYSIZE}}}{\underset{(5.56)}{18.50\ X_4}} - \underset{\substack{\text{CHIL 6}}}{\underset{(7.76)}{19.12 X_7}} - \underset{\substack{\text{CHIL 6-12}}}{\underset{(8.16)}{9.55\ X_8}} - \underset{\substack{\text{ADULTS 18+}}}{\underset{(8.71)}{18.47\ X_{10}}} - \underset{\substack{\text{VACDAYS}}}{\underset{(.431)}{1.24\ X_{11}}} + \underset{\substack{\text{OCC-OPERATIVE}}}{\underset{(12.91)}{29.35 X_{21}}}$$

EQUATION II: (Trips)

$$X_6 = -23.26 - \underset{\substack{\text{SUBURBAN}}}{\underset{(9.30)}{12.55\ X_2}} + \underset{\substack{\text{GASCOSTS}}}{\underset{(.108)}{.18\ X_3}} + \underset{\substack{\text{FAMSIZE}}}{\underset{(2.71)}{8.41\ X_4}} + \underset{\substack{\text{ADULTS}}}{\underset{(4.37)}{6.58\ X_{10}}} - \underset{\substack{\text{OCC-SALES}}}{\underset{(17.09)}{20.28\ X_{19}}} - \underset{\substack{\text{OCC-CRAFT}}}{\underset{(8.89)}{16.33\ X_{20}}}$$

EQUATION III: X_{10} (Vacations or Trips)

$$= .83 + \underset{\substack{\text{GASCOSTS}}}{\underset{(.067)}{.11\ X_3}} + \underset{\substack{\text{CHIL 6-11}}}{\underset{(5.11)}{7.93\ X_{12}}} + \underset{\substack{\text{CHIL 12-18}}}{\underset{(4.53)}{12.76\ X_{13}}} + \underset{\substack{\text{ADULTS}}}{\underset{(5.55)}{6.20\ X_{14}}} - \underset{\substack{\text{VAC DAYS}}}{\underset{(.404)}{.56\ X_{15}}}$$

APPENDIX C

Appendix C contains current and projected values for all independent variables entering into the regression equations. Sources are also cited.

A. PROPORTION OF PEOPLE LIVING IN URBAN, RURAL, AND SUBURBAN AREAS:

Source: U.S. Department of Commerce, Bureau of the Census Current Population Reports, Summary of Housing Characteristics for the United States, HC (S1), 1, February 1972, Table 2.

1970		2020 (projections not available)	
Rural	.265	Rural	.250
Urban	.336	Urban	.351
Suburban	.399	Suburban	.399

B. GASOLINE EXPENDITURES PER FAMILY--VACATIONS AND TRIPS

Source: Data from National Recreation Survey, and assumption of 2020 price of gasoline of $1.00 per gallon in 1972 dollars. Elasticity of demand for gasoline (long run) projected to -.65. See research paper by James Sweeney, Federal Energy Administration, 1975.

1972		2020	
vacations	$40.23	vacations	$58.74
trips	$13.14	trips	$19.18
both	$26.69	both	$38.96

C. NUMBER OF FAMILIES

Source: Linear extrapolation of projections to 1990--U.S. Department of Commerce, Bureau of the Census Current Population Reports, Population Estimates and Projections, Demographic Projections for the United States, Series P-25, No. 476, February 1972, Table 7.

1972	2020
53,639,000	98,576,000

D. MEAN AGE, HEAD OF HOUSEHOLD:

Source: Linear extrapolation and interpolation of data and projections from 1965-1990 in five year increments. U.S. Department of Commerce, Bureau of the Census Current Population Reports, Population Estimates and Projections, Demographic Projections for the United States, Series P-25, No. 476, February 1972, Table 7.

1972	2020
44.31	41.04

E. MEAN FAMILY SIZE

Source: This result was obtained by dividing the result of "C" above into the following: U.S. Water Resources Council, 1972 OBERS Projections, Volume V, p. 4, Table 1. (Population projection of 399,013,000)

1972	2020
3.90	4.04

F. RELATIVE AGE DISTRIBUTION OF FAMILIES

Source: U.S. Department of Commerce, Bureau of the Census Current Population Reports, Population Estimates and Projections, Estimates of the Population of the United States by Age and Sex: April 1, 1970 to July 1, 1972. Series P-25, No. 490, September 1972, Table 2.

	1972	2020
Under 6	.102566	.127916
6-11	.112128	.120932
12-17	.118816	.112455
18+	.666497	.638693

G. ABSOLUTE FAMILY AGE DISTRIBUTION

Source: Multiplying Mean Family Size figures (E above) by the relative proportions in the four age groups. (F above)

	1972	2020
Under 6	.400	.517
6-11	.437	.488
12-17	.463	.455
18+	2.600	2.580

H. VACATION DAYS PER YEAR, HOUSEHOLD HEAD

Source: National Recreation Survey Data (1972), for projected values, see Bruce McGurk, "Recreation Models for Outdoor Recreation Planning in Western River Basins and Mountain Regions, 1975, p. 20.

1972	2020
2.705	3.291

I. YEARLY FAMILY INCOME, (Thousands of dollars)

Source: U.S. Water Resources Council, 1972 OBERS Projections, Volume V, p.4, Table 1. OBERS projections only give per capita incomes projected to the year 2020. This figure was multiplied by projected family size for 2020. This, in turn, was multiplied by 1.24, the Consumer Price Index in 1967 dollars.

1972	2020
17.518	71.437

J. MARITAL STATUS--PERCENTAGE OF THE POPULATION MARRIED

Source: 1970 Census of Population

1970	2020
65.8	projections not available--assume 65.8

K. PROPORTION OF PEOPLE LIVING IN SINGLE DWELLING UNITS:

Source: U.S. Department of Commerce, Bureau of the Census Current Population Reports, Summary of Housing Characteristics for the United States, Regions, Divisions, and States 1970, Series HC(S1), February 1972, Table 2.

1970	2020
.694	.567

L. RELATIVE PROPORTIONS OF POPULATION IN ALTERNATIVE JOB CLASSIFICATIONS

Source: N.H. Rosenthal, "Projected Changes in Occupations," Monthly Labor Review, Bureau of Labor Statistics, Vol. 96, No. 12, December 1973. (The figures were altered slightly to account for the population in the armed forces)

Professional, technical	.1367	.1659
Farmers and farm workers	.0202	.0084
Managers, officials and proprietors (non farm)	.0958	.0994
Clerical and kindred	.1700	.1871
Sales Workers	.0639	.0612
Craftsmen, foremen, and kindred	.1290	.1235
Operatives and kindred	.1616	.1452
Private Household workers	.0171	.0103
Service workers, except private household	.1137	.1248
Farm laborers and foremen	.0165	.6068
Laborers excluding farm and mine	.0503	.0421
In armed forces	.0253	.0253

M. PERCENTAGE OF POPULATION IN CALIFORNIA AND COLORADO:

Source: U.S. Water Resources Council, 1972 OBERS Projections, Volume V, pp. 4, 27, 30; Table 1 on each page.

1972	2020
.1090	.1288

N. MEDIAN NUMBER OF YEARS OF EDUCATION (Means not available)

Source: U.S. Department of Commerce, Bureau of the Census Current Population Reports, Population Estimates and Projections, Demographic Projections for the United States, Series P-25, No. 476, February 1972, Table 5. (An extrapolation of the 1990 figure)

1972	2020
12.2 years	13.4 years

APPENDIX D*

Appendix D gives projected total use of the wilderness in visitor days per year. All algebraic calculations and pertinent references are indicated in this appendix.

Given a total of 115.0 million visitor days of remote and wilderness camping consumed in 1972, of which .602 was estimated to be vacation-oriented and .398 trip-oriented,[18] below are the calculated estimates of total visitor days per year in 2020 for all three categories:

VACATIONS

69.23	million visitor days (1972) divided by:
34.76	visitor days per participating family (1972) EQUALS:
1.99	million participating families (1972) divided by:
53.64	million total families (1972--Appendix C) EQUALS:
.0371	probability of a family participating in 1972, assumed to be the same probability in 2020, multiplied by:
399,012,000.00	projected 2020 population (Appendix C) divided by:
4.04	projected persons per family 2020 (Appendix C) EQUALS:
3,664,194.00	estimated participating families, 2020, multiplied by:
48.16	projected visitor days per family 2020 (p.14) EQUALS:
176,467,583.00	estimated total visitor days per year 2020

* Note that the figures on this page and on the top of the next page do not sum to the figure on the bottom of the next page. Indeed, we would not expect this to be the case unless the same independent variables were included in all three equations. But since a different set of independent variables proved significant in each of the three cases, we should not expect equation I and II's projections to sum to that of equation III.

TRIPS

45.77	million visitor days (1972) divided by:
25.56	visitor days per participating family (1972) EQUALS:
1.79	million participating families (1972) divided by:
53.64	million total families (1972--Appendix C) EQUALS:
.0334	probability of a family participating in 1972, assumed to be the same probability in 2020, multiplied by:
399,012,000.00	projected 2020 population (Appendix C) divided by:
4.04	persons per family (Appendix C) EQUALS:
3,298,763.00	estimated participating families, 2020, multiplied by:
29.59	projected visitor days per family 2020 (p.14) EQUALS:
97,610,397.00	estimated total visitor days per year 2020

VACATIONS-TRIPS (unspecified)

115.00	million visitor days (1972) divided by:
27.74	visitor days per participating family (1972) EQUALS:
4.15	million participating families (1972) divided by:
53.64	million total families (1972--Appendix C) EQUALS:
.0774	probability of a family participating in 1972, assumed to be the same probability in 2020, multiplied by:
399,012,000.00	projected 2020 population (Appendix C) divided by:
4.04	persons per family (Appendix C) EQUALS:
7,644,438.00	estimated participating families, 2020, multiplied by:
28.94	projected visitor days per family 2020 (p.14) EQUALS:
221,230,036.00	estimated total visitor days per year 2020

ENDNOTES

[1]George H. Stankey, "Wilderness: Carrying Capacity and Quality." The Naturalist 22(3): 7-13, 1971, p. 1.

[2]Marion Clawson and Jack L. Knetsch, Economics of Outdoor Recreation (Baltimore: Johns Hopkins Press, 1966), p. 121.

[3]Clawson and Knetsch, p. 115.

[4]Clawson and Knetsch, p. 116.

[5]Robert J. Kalter and Lois E. Goose, "Outdoor Recreation in New York State: Projections of Demand, Economic Value, and Pricing Effects for the Period 1980-1985," (Ithaca: Cornell University Press, 1969).

[6]The elasticity of demand is the percentage change in quantity demanded divided by the percentage change in price.

[7]U.S. Department of the Interior, Outdoor Recreation, A Legacy for America, Appendix "A," an Economic Analysis, (Washington: 1973), p. I-5.

[8]Ibid., p. I-99.

[9]Ibid., p. I-100.

[10]Ibid., p. I-209

[11]Ronald J. Wonnacott and Thomas H. Wonnacott, Econometrics (New York: John Wiley and Sons, Inc.), pp. 68-70.

[12]1973 World Almanac, (New York: Newspaper Enterprise Association, Inc.) p. 119.

[13]It is assumed here that the wife of a male head of household earns 75% of his earnings.

[14]At an earlier stage in this study the five variables (1. gasoline costs; 2. education-household head; 3. vacation days per year; 4. yearly family income; 5. marital status-household head) were "forced" into the regression equations. However those regression equations proved unuseable. This was because the resulting equations yielded negative predictions associated with the projected independent variables.

[15]Means were used when possible; however some of the census data was available in median form only.

[16]U.S. Department of the Interior, p. 5.

[17]See Appendix "A" of this report.

[18]U.S. Department of the Interior, p. 5.

[19]U.S. Department of the Interior, p. 5.